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ABSTRACT

Black students, other minorities and white students can show significant increases in achievement in biology by using a cooperative learning model. Concentrating on cooperating with group members toward a common goal is the ingredient that makes this cooperative learning model work. This study was designed to investigate the effects of cooperative learning exercises on the achievement of ninth grade multi-cultural biology classes. The study was conducted over a two-year period. Results indicated that the experimental group plus seven of the eight experimental subgroups had higher mean scores on the post test. This indicated a consistent improvement in achievement, over the long term, for students using the cooperative learning model. The study also indicated that past cooperative group performance in one area may be used to predict future group performance in another. It indicated an importance to have one high achiever in each cooperative learning group. (CW)

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A STUDY OF THE EFFECTS OF A COOPERATIVE LEARNING PROGRAM ON THE ACHIEVEMENT OF NINTH GRADE MULTI-CULTURAL GENERAL BIOLOGY CLASSES

by

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A Research Paper Submitted To

The Alexandria City, Virginia School Board

Regarding

Teaching Techniques Aimed at Improving Existing

Programs in This School Division as Per Grant Requirement

May 1989

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A STUDY OF THE EFFECTS OF A COOPERATIVE LEARNING PROGRAM ON THE ACHIEVEMENT OF NINTH GRADE MULTI-CULTURAL GENERAL BIOLOGY CLASSES

by

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May 1989

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Abstract

Black students, other minorities and white students can all show significant increases in achievement in biology by using the model developed by the researcher in this study. Concentrating on cooperating with group members toward a common goal is the ingredient that makes this cooperative learning model work.

This research paper was completed in response to a mini-grant provided by the Alexandria City School Board to promote excellence in education and encourage teacher initiative in developing new teaching techniques and improving existing programs in the school division (APPENDIX G).

The need for developing effective and efficient methods of presenting academic subject matter in science to our students was brought out by the National Assessment of Educational Progress (NAEP). The NAEP cited a comparison of American ninth-graders to fifteen countries. They rated second to last in science. American students that considered themselves advanced in science ranked last in biology. This study should sound an alarm.

Educators need to spend more time on developing strategies to get students to inquire rather than to require subject matter to be learned just to be learning it. This is a major challenge facing

educators. Are educators going to deal with this challenge successfully? Teachers need to "roll up their sleeves" and start trying new creative methods so students may once again start achieving. Biology should be a prime target for improvement.

This study was designed to investigate the effects of cooperative learning exercises on the achievement of ninth grade multi-cultural biology classes. The study was conducted over a two year period. The control and experimental groups were taught by the same instructor during the 1987-1988 and 1988-1989 school years, respectfully. Students in the study were ninth graders attending a junior high school in the Alexandria City, Virginia School District. This school system was multi-cultural with approximately forty per-cent black, forty per-cent white, and twenty per-cent various other ethnic groups. The control group sample consisted of forty students in three classes of ninth grade biology. The experimental group consisted of forty two students in three classes of ninth grade biology that were taught at exactly the same times during the day as the control group. The instructor was a white male with over twenty five years of experience teaching science courses in the public secondary schools of Virginia.

A cooperative learning model was developed by the researcher and used by the experimental group as the treatment. This model was used to prepare students for each chapter test. The model was three consecutive days in a cycle, consisting of two specifically designed cooperative learning activities followed by an individual chapter test on the third day of the cycle. The control group did not use the model and was taught using traditional methods involving very little group activity.

The experimental group showed a significant increase in

achievement over the control group when measuring the effects of cooperative learning on short term chapter tests.

Both black males and black females in the experimental group showed significant increases in achievement over their counterparts in the control group when measuring the short term effects of the cooperative learning model. This indicated that the cooperative learning model had the positive effect of producing significant increases in achievement for black students on short term items such as chapter tests.

A most important aspect of this study was the fact that both black students and white students in the experimental group showed significant increases in achievement over their control group counterparts on short term items such as chapter tests. The study not only indicated that both black students and white students improved significantly on chapter tests but black students achieved more and were actually gaining on their white peers. This positive aspect of closing the gap must be pursued.

Over the long term, the experimental group plus seven of the eight experimental subgroups had higher mean scores on the post test. This indicated a consistent improvement in achievement, over the long term, for students using the cooperative learning model. Long term achievement improved much more slowly than short term achievement.

The study also indicated that past cooperative group performance in one area may be used to predict future group performance in another. It indicated an importance to have one high achiever in each cooperative learning group.

Overall, this study indicated that the use of the cooperative learning model is more effective and efficient than using traditional

approaches with general biology students in a multi-cultural environment.

This study contains empirical data which may be of value to educational researchers in the area of cooperative learning.

Finally, the researcher produced and narrated a video on VHS tape. This video contains actual students in the study as they were using the cooperative learning model in the experimental group. Student reactions to the preceding day's cooperative learning activities can be witnessed as students arrived to class before the tardy bell rang. Student-teacher interaction and student-student interaction may be seen first hand. Thus, roles played by members of biology classes can be witnessed and evaluated for efficiency and effectiveness.

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CHAPTER I

INTRODUCTION, STATEMENT OF THE PROBLEM, HYPOTHESES, AND ORGANIZATION OF STUDY

INTRODUCTION

The National Assessment of Educational Progress (NAEP) has conducted research which shows negative trends in high school achievement in science and mathematics. The NAEP and other researchers have indicated that students have not been properly motivated to learn subject matter effectively. What kinds of techniques should be used by educators to motivate students? This problem must be solved or the public school systems, as we know them, will not help students reach their potential.

According to Maslow, psychologically healthy people continue to achieve, rather than reach an achievement plateau, since they are or have become growth motivated.[1]

Since, according to Maslow, achievement itself is a motivator, students may never reach high levels of motivation unless educators develop strategies to help high school students achieve in academic areas. This problem is compounded when underachieving, non-motivated minorities are involved, since they have already missed so many experiences in the past. Many low-achieving students, regardless of their effort, cannot make it to the top of the class. This may cause such students to be destructive rather than constructive.

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[1] Robert S. Zais, Curriculum (New York: Thomas Y. Crowell Company, 1976), p. 221.

High performing students, on the other hand, may not do their best either because they know they will be near the top anyway. These attitudes may alienate low and high performing students. Delinquency or withdrawal is the way low achieving students can maintain a positive self-esteem in this kind of negative educational environment.

It is possible that students are being made to adapt to the public schools rather than the schools adapting to the students. Public schools may be changing much more slowly than the clients being served. A more appropriate balance of extrinsic factors and intrinsic factors may produce better results. Appropriate subject matter is needed but may be of little use if students are not motivated to learn it effectively.

Biology may mean less than nothing to some students. It will be the self-esteem and stimulation from rewarding activities that are important. When groups investigate things they must be arranged so students have the experience of creating a group that is dedicated to inquiry in the appropriate area of knowledge.

Research has shown that students enjoy explaining what they understand about subject matter to peers. This inherent sense of nobility in our youth needs to be explored by giving students the opportunity to act as tutors during group exercises. How would students respond if they were allowed to work on academic materials in small groups? What kinds of creative techniques that work can be engineered to solve the problems of cooperation between students who work together in groups? Children will not cooperate just because they are told to do so.

Educators should spend more time on developing strategies to

get students to inquire rather than to require subject matter to be learned just to be learning it. Cooperative learning strategies should be engineered which involve less individual competition and more cooperation between students operating in small groups.

The cooperative learning program, used by the experimental group in this study, was an attempt to use strategies, designed to improve motivation, which would lead to significant increases in achievement. Thus, the model was designed to adapt to the students needs, based on past studies and theory, rather than the students adapting to the model.

Statement of the Problem

This study investigated the effects of a cooperative learning program on the achievement of ninth grade multi-cultural biology classes.

The variables to be defined are: ninth grade multi-cultural general biology classes, cooperative learning program, and achievement. Operational definitions for these three variables are:

1. Ninth grade multi-cultural general biology classes were grouped students from three different classes of ninth grade general biology at a junior high school in Alexandria City, Virginia. The classes were multi-cultural. Black students and white students were the two main cultures in this study. There were a very small number of minorities other than Black students. These minorities were of Oriental, Hispanic, and Asiatic Indian Ancestary. For purposes of this study minorities other than blacks were placed in the White category.

After several months of experimenting with cooperative learning strategies and getting familiar with the students in each class

students were divided into teams or groups of three or four. Each group was composed of at least one high achiever, one low achiever, and one average achiever as demonstrated on the many chapter tests from the biology text prior to the beginning of this study. Four member groups had two average achievers. Different ethnic students and opposite sexes were also placed in each group where feasible. Two of the three classes had five different groups and one class had four different groups.

2. The cooperative learning program is a model. The interacting elements were the grouped students and modifications of two of the most extensively researched and widely used cooperative learning methods developed by David DeVries, Keith Edwards, Robert Slavin, and their colleagues at Johns Hopkins University.

Modifications of Students-Teams Achievement Divisions (STAD) and Teams-Games-Tournament (TGT) were the cooperative learning strategies used to motivate the groups of students.

In STAD the teacher first presented a lesson. The students then met in three or four member teams to attempt to master a worksheet which was coordinated with an individual test, to be given another day on an individual basis. Each team was given two identical worksheets and one answer sheet. Each team gave the worksheets and completed answer sheet to the teacher upon completion. The teacher graded the answer sheets from each group. Graded answer sheets were returned to the respective groups at the beginning of the next class period. Each graded answer sheet contained the number correct and the group placement when compared to other groups in that same class. Groups were then given the two worksheets so they could discuss and learn missed questions or review the whole worksheet if necessary.

Groups were not given the answers. Groups were allowed fifteen to twenty minutes to discuss the answers. At the end of this fifteen to twenty minute period (TGT) was started.

In TGT students from each group represented that group in an academic game. One member from each group met with another group called the competitive group. The competitive groups were assigned by the instructor so students of approximately the same ability levels competed against each other. When the academic game was completed each person in each competitive group gave their placement to the instructor. The placements that group members brought back to their regular team or group were averaged by the teacher. Placements were given to teams at the beginning of the next class period.

The TGT game consisted of a deck of cards with numbers on each card, the worksheet from STAD containing the numbered multiple choice and/or true-false and/or matching questions, and an answer sheet. The deck of cards was shuffled and placed on the table with the numbers facing down. One student picked the top card. The number on this card was the number of the question he/she was to attempt to answer. Another student looked at the answer sheet to tell the student if he/she was correct or wrong. If correct that student kept the card. If wrong the card went to the bottom of the deck. The person with the most cards at the end of the forty-five question game placed first in that competitive group.

The next day when groups were given their TGT placements students took an individual test on the same questions covered on the preceding two days of cooperative learning. The team averages on the individual tests were also kept by the instructor and the placements given to

students when graded tests were returned. The individual tests contained the same questions covered during STAD and TGT but were in different order. These individual tests were the tests that were statistically analyzed for short term achievement during this study.

Thus, the cooperative learning model is a three class period cycle: STAD, TGT, and individual test on the third day. Labs, video tapes, discussions, and other activities were given between the three day cycles. The three day cycle was repeated six times and the average scores by the experimental group students on the six individual tests served as the dependent variable data for measuring short term achievement. The following table is an outline of the cooperative learning model for one chapter.

CYCLES	CONSECUTIVE CLASS PERIODS	LEARNING EXERCISE	SUBJECT MATTER	TIME	REWARD
1	3	STAD	SHORT ANSWER QUESTIONS	(DAY 1) (1) 30-40 MINUTE PD.	TEAM PLACEMENT GRADE
		TGT	SAME AS STAD	(DAY 2) (1) 30-40 MINUTE PD.	TEAM PLACEMENT GRADE
		INDIVIDUAL EXERCISE	TEST ON SAME QUESTIONS COVERED DURING STAD & TGT	(DAY 3) (1) 30-40 MINUTE PD.	TEAM PLACEMENT AND INDIVIDUAL GRADE

3. Achievement was measured using two different methods. One method was to measure long term achievement while the second method was to measure short term achievement. The 1987 National Science Olympiad Achievement Test was used as a pretest and posttest for measuring long term achievement. This test was administered to both control and experimental groups. It also served as the covariate

for equating differences between control and experimental groups on the pretest for differences on the posttest. The Analysis of Covariance was the statistic used to determine if significant differences occurred. Short term achievement was measured by using average test scores for students on six standardized chapter tests for both control and experimental groups. The 1987 National Science Olympiad Achievement Test was used as a covariate for equating differences between control and experimental groups in analyzing this short term data. The Analysis of Covariance was the statistic used to determine if significant differences occurred.

Thus, comparison of scores between experimental and control groups on a short term and then on a long term basis indicated the effectiveness of the cooperative learning model.

Correlations, using the Pearson R statistic, were made involving the experimental group. These correlations were determined to check for trends of academic behavior during the time the six standardized tests were given to the experimental group. The variables that were checked for relationships were:

1. (STAD) group test average;
2. Individual with highest test score in group;
3. Average of individual test scores per group;
4. (TGT) average group placement per group.

One correlation, using the Pearson R statistic, was made to check for a relationship between control and experimental groups. This analysis involved averages for control and experimental group students on each of the six chapter tests.

A final correlation, using the Pearson R statistic, was made to

determine if a significant relationship existed between short term findings from the Analysis of Covariance and long term findings from the Analysis of Covariance.

The relationships investigated between the variables in this study were cause-effect.

The purpose of the study was to determine if a cooperative learning program (the cause) produced significant increases on achievement scores (the effect). This cooperative learning method would be simple to implement, inexpensive to operate, and may increase achievement scores significantly.

Hypotheses

Based on Maslow's Theory and present motivational trends used in developing the cooperative learning model it was assumed:

1. Students working in small groups using cooperative learning methods would show significant increases in achievement in the long term over students not working in small groups and not using cooperative learning methods.

2. Students working in small groups using cooperative learning methods would show significant increases in achievement in the short term over students not working in small groups and not using cooperative learning methods.

Organization of Study

Chapter I has dealt with the introduction and statement of the problem. This chapter stresses a need for the development of motivation strategies to increase student achievement in academic areas. Since research has shown that students enjoy explaining subject matter to their peers, this element should be explored further.

Instead of the teacher doing most of the talking, how would students respond if they were allowed to work on and discuss academic materials in small groups? The teachers role would be as a consultant. Thus, these motivational tools have been used in this study. The goal was to produce significant increases in achievement by using a cooperative learning model.

Chapter II is The Review of Related Literature which gives insight into three important areas. These areas are interrelated and designed to increase one's knowledge of the present state of education as compared to education in the past. Suggestions, based on research, are made regarding shifting emphasis on the student being more responsible for learning as they interract with their peers using cooperative learning techniques. The teacher using this method becomes more of a consultant. Many researchers feel that there is little need to prove the feasibility of cooperative learning theory, since they believe it has already been proven to work. If this is so, education now needs effective cooperative learning models developed by program engineers.

Chapter III, Methodology, indicates the basic structure of the design. This chapter describes the specific aim of the study, statement of the research hypothesis, description of subjects, instruments, experimental design, procedure, statistical hypotheses, and limitations.

Chapters IV and V, The Statistical Analyses, explains how the control and experimental group data was analyzed for significant differences and significant correlations between variables.

Chapter VI contains a summary of the study, conclusions, implications, recommendations to improve the study and suggestions for

further study.

The appendixes contain empirical data, forms, and explanations regarding factors in the study.

The bibliography is a compilation of selective literature regarding topics related to this study.

CHAPTER II

REVIEW OF RELATED LITERATURE

Education in the Past

Decades ago educators recognized 10 to 40 percent of the average and above average students as failing to utilize their potential in school learning. These children have continued to be a source of confusion for their parents, their teachers, and even for themselves.[1]

Educational researchers have known for decades that students with poor attitudes toward school often consider themselves to be at least average in academic ability. These students adopt certain attitudes if their self-esteem is threatened by school activities. By taking a negative attitude a student can protect one's self-esteem, maintaining that one is a good student by rationalizing that the reason for no achievement is not because of a lack of ability but because of a lack of being interested enough to try. This false type of self-concept hinders achievement. Negative school attitude serves as a protective function.[2]

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[1] Irene D. Hassett, A Preliminary Report on Community Collaboration: How it Enhanced Training of Professionals and Pre-Professionals, Involved Parents and Schools, and Expanded Services for Childrens' Psycho-Educational Needs (New Orleans: ERIC Document Reproduction Service, ED 115 368, 1974), p. 3.

[2] Lewis Paddy, Significant Others, Self Concept of Ability, and Achievement (San Francisco: ERIC Document Reproduction Service, ED 128 699, 1973), p. 7.

Over a decade ago the federally funded National Assessment of Educational Progress (NAEP), directed by the Education Commission of the United States, pinpointed weaknesses in mathematics and science progress. The results of two studies conducted by the NAEP based on the estimated 3.5 million school-age students represented by the groups tested showed:

1. American young people knew less about science in 1975 than children of the same age in 1969 to 1970. For example, approximately eighty thousand fewer seventeen-year-olds could answer a question based on the knowledge of devices used in electric power transmissions.

2. Although 60 percent of the nations's seventeen-year-olds could perform addition, subtraction, multiplication, and division, only 35 percent could solve simple multiplication problems with decimals. At that time researchers felt that such negative trends in education could no longer be ignored or the public school systems, as we knew them, would be destroyed.[3]

Over a decade ago it was reported that youth may expect greater intrinsic rewards than youth of the past. A comparison of a 1960 survey of 400,000 high school students with a 1970 survey of a representative sample showed a marked shift in values. The shift was from students valuing job security and opportunity for promotion in 1960 to freedom to make decisions and to do meaningful work in 1970. This trend showed a shifting from placing greater values

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[3] Arthur H. Elliott, "Turning It Around in Education with student tutoring," The Clearing House 50 (March 1977): 285-290.

on extrinsic rewards in 1960 to greater values on intrinsic rewards in 1970.[4]

Education Today

Today, American science students performance is "distressingly low". Only 7 percent of American seventeen-year-olds are prepared to take college science courses. Achievement is significantly below 1969 levels among seventeen-year-olds. Hispanic and Black students aged thirteen and seventeen are at least four years behind their white peers. Boys are outperforming girls by a widening margin as students age. Most seventeen-year-olds are not equipped for informed citizenship. They could not function effectively in the workplace and cannot pursue postsecondary studies in science. The National Assessment of Educational Progress (NAEP) measured knowledge in science for nine-year-olds, thirteen-year-olds, and seventeen-year-olds in 1986 and compared the results with those of 1969. The three age groups have recovered slightly from declines in the 1970s', however, older students are still lagging while 1970 levels have just been reached by nine-year-olds. This study shows that American students are ill equipped in science and mathematics and will not be competitive with students from other nations. The NAEP study cited a comparison of American ninth-graders to 15 countries. They rated second to last in science. American students that considered themselves advanced in science ranked last in biology[5] This study should sound an alarm.

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[4] Paul D. Krivonis, The Relationship of Intrinsic-Extrinsic Motivation and Communication Climate in Organizations (San Francisco: ERIC Document Reproduction Service, ED 131 512, 1976), p. 6.

[5] "Science Know-How of Youths Called Distressingly Low," The Washington Post 23 September 1988, p. A3.

Past and Present Educational Strategies for Classroom Use

Students create their own culture and way of life as a group as they undertake activity. Motivation is an important factor for an activity. The motivation source for activity is that each student has a stake in the expectations and standards that become established. Students care about the way of life that will be possible in the class. Students have strong psychological needs for being in the kind of classroom where they can survive. To some students biology may mean less than nothing. It will be the self-esteem, freedoms, growing adequacy and stimulation from rewarding activities that are important. When groups investigate things they must be arranged so students have the experience of creating a group that is dedicated to inquiry in the appropriate area of knowledge.[6]

There are at least two types of activities in all classrooms. One is the classroom group as a society. The second type of activity places the student in the role of "learner" and deals with the subject matter that is being taught. The student plays this role by working exercises, reading textbooks, taking notes, studying for tests, etc. In an activity-centered environment the rationale is that the student must participate in the activities in order to learn what is expected. This inquiry point of view is that students learn more effectively when their learning is aimed at a predetermined goal. If this condition exists the student will listen to relevant opinions from both the teacher and the other students and will not only act but will think about what he/she is doing. The

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[6] Herbert A. Thelen, Education and the Human Quest (New York: Harper and Row, 1960), pp. 147-148.

student will get feedback from his own behavior and he can use this feedback to correct or plot next steps. This inquiry method is best suited for a heterogeneous group where the success of teaching depends more on the adequacy of the inquiry method than on the method used for selecting the children. The question of how effectively the class is inquiring is itself a legitimate question to ask and investigate. In developing methods where inquiry can be effective we are inquiring. This produces a merging of teaching and management functions within the one rationale of education.[7]

Using students as tutors places students in positions of increased responsibility and trust, inherent in the position, rather than requiring responsibility and trust before the position is acquired. Using student tutors creates a more goal oriented problem solving attitude on the part of the tutor.[8]

Student involvement in classwork can be increased if students are encouraged and allowed to tutor other students having difficulty. This effort can cut across all levels of achievement. It works well for good students as well as indifferent students. Youth have an inherent sense of nobility. We need to give students the opportunity to investigate their sense of nobility by allowing them to act as tutors.[9]

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[7] Herbert A. Thelen, Classroom Grouping for Teachability (New York: John Wiley and Sons, Inc., 1967), pp.18-22.

[8] Peggy Lippitt, Cross-Age Helping Programs and Suggested Designs Which Have Worked Well in Cross-Age Helping Programs (Washington, D. C. : ERIC Document Reproduction Service, ED 108 086, 1975), p. 3.

[9] Kimball L. Howes, Large Schools: Can They Be Humanized Through Student Staff Relationships (Dallas: ERIC Document Reproduction Service, ED 127 708, 1973), p. 6.

Methods must be developed to interest school personnel in tutoring. Enlisting school personnel can make them more a part of the system and less apart from it. No energy needs to be expended in proving that tutoring works. Attention should now be devoted to the applications of tutoring.[10]

Humans are successful animals because of our ability to apply our intelligence to cooperation with other humans to accomplish group goals. Cooperative groups such as teams, clubs, political parties, families, work groups, and neighborhoods make up our society. Competitive elements exist in these groups but all will lose if individuals cannot cooperate to achieve a common goal. In light of these cooperative elements in our society our schools are among the institutions in our society least characterized by cooperative activity. Some school cooperative activity does exist in laboratory groups, project groups, and so on but, for the most part, independent work characterizes the students agenda and they are individually compared with one another for grades, praise and recognition. This kind of individual competition does not have the positive features between well-matched competitors. Many low-achieving students, regardless of their effort, can not make it to the top of the class because they have already missed so much in the past. They may try to be destructive rather than constructive. On the other hand, high-performing students may not do their best either because they know they will be near the top anyway. This pecking order alienates high and low performing students. Thus, delinquency or withdrawal is the only way low achieving students

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[10] Ralph J. Melaragno, "Pupil Tutoring: Directions for the Future" The Elementary School Journal 77 (May 1977): 384-387.

can maintain positive self-esteem in this hostile educational environment. Some educators feel that if individual competition between students is not the answer, cooperation between students must be. How would students respond if they were allowed to work on academic materials in small groups? Of course cooperation between students has its own problems. What would keep one or two students from doing most of the work? Why should students help each other? Why should they care how their class mates are doing? What would keep the more capable students from belittling the less capable students? How could low achieving students contribute to the group? Children will not cooperate just because their teacher tells them to cooperate. Programs have to be "engineered" to deal with these problems in the classroom.[11]

Summary

In taking a look at education today, the negative trend seems to be escalating while todays students may be more motivated by extrinsic rewards such as the students of 1960. Since extrinsic-intrinsic reward system strategies must keep up with the needs of students, failure on the part of students can be at least partially due to a failure of educators to quickly correlate teaching strategies to student needs. Some teachers use one strategy, as other teachers use opposing strategies with little correlation from teacher to teacher and course to course. This problem is compounded as one takes into consideration the many school districts in each state. If there is little coordination within each school district there may be practically no coordination between school districts.

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[11] Robert E. Slavin, "Synthesis of Research on Cooperative Learning," Research Information Center, May 1981, pp. 655-660.

Research, student needs, and implementation of teaching strategies need to be much more coordinated for students to have their needs met. Historically, research shows that student needs change. These changes need to be correlated with strategies quickly.

Some of the theories, based on research, that were in existence decades ago can be used in trying to create more effective educational experiences for present day students.

Activity centered courses with tutoring by better equipped students is one direction educators can take in attempting to create cooperative learning experiences for students in todays educational climate.

Educators need to spend more time on developing strategies to get students to inquire rather than to require subject matter to be learned just to be learning it. This is a major challenge facing education. Are educators going to deal with this challenge successfully?

Cooperative learning strategies should be engineered. These strategies should be aimed at less individual competition and more cooperation between students operating in small groups. Group competition, which promotes the positive side of this element, should be explored as a motivational tool instead of individual competition. Schools should promote programs which are analagous to real life cooperative groups such as teams, clubs, political parties, families, work groups, and neighborhoods. Why should schools be different than real life society out of schools? Most schools offer few such analagous experiences. Of course, cooperative learning in small groups is no quick panacea for the low achiever. Many problems need to be researched. What would keep one or two students in each

group from doing all of the work? What would keep the more capable students from belittling less capable students? These problems and many others need to be solved. Programs need to be engineered to effectively provide for such problems since children will not cooperate just because they are told to do so. Teachers need to "roll up their sleeves" and start trying new creative methods to solve effectively such problems within the cooperative learning framework of reference. Our schools will then be in line with real life group situations and students may once again start achieving, but this time in the more cooperative way of reaching a common goal with satisfaction for all.

CHAPTER III

METHODOLOGY

Specific Aim of the Study

The specific aims of this study were to answer the following two questions:

1. What effect does cooperative learning have on the short term achievement of ninth grade biology classes in a multicultural environment?

2. What effect does cooperative learning have on the long term achievement of ninth grade biology classes in a multicultural environment?

Research Hypotheses

Since many researchers have found negative trends in high school achievement in science, effective strategies aimed at improving student achievement need to be developed.

Our best science students in America seem to be weakest in the area of biology. Biology may mean very little to some students. It may be the stimulation from rewarding activities that are important. Therefore, cooperative learning exercises served as the rewarding activities in this investigation. This use of the cooperative learning model to get students involved with the subject matter would be simple to implement, inexpensive to operate, and may increase achievement scores significantly. Therefore, it was hypothesized:

1. Experimental groups, using cooperative learning exercises,

will show significant increases in achievement over control group students, not using cooperative learning exercises, in ninth grade multicultural biology classes over the short term.

2. Experimental groups, using cooperative learning exercises, will show significant increases in achievement over control group students, not using cooperative learning exercises, in ninth grade multicultural biology classes over the long term.

Description of Subjects

Sample groups for this study were chosen from one specific junior high school. The average membership at this school was approximately nine hundred students. One other junior high school also served as a feeder school to the senior high school in this school district. The two junior high schools were approximately the same size. The senior high school had approximately two thousand two hundred students in grades ten, eleven, and twelve. This city school district had a total student membership of about nine thousand students and was multicultural. There were three regular biology classes in the junior high school being studied. The same teacher taught the three classes.

To be enrolled in biology a student was recommended by his/her eighth grade physical science teacher, generally. Students should be average or above in the fundamentals of reading and mathematics. Some students were above average. Many students were below average since almost any student could have been admitted if admittance was demanded. Thus, students in classes ranged from very high aptitude to very low aptitude. The three existing experimental groups chosen for this study were largely average and were taught during the

second, third, and fifth periods in the day, during the 1988-1989 school year. The second period class interval was 9:48 A. M. to 10:42 A. M. The third period class interval was 11:19 A. M. to 12:13 A. M. The fifth period class interval was 1:17 P. M. to 2:11 P. M.

The existing control groups were chosen during the same periods in the day and at the same times. They were chosen from the same school, and had comparable characteristics to the experimental group. Control group data was gathered during the 1987-1988 school year when the same teacher used no cooperative learning exercises.

Control groups were combined and treated as one control group as were the experimental groups.

Instruments

Biology subjects were pretested and posttested. This test was the 1987 Biology National Science Olympiad Achievement Test. This test (Appendix B) consisted of forty multiple choice questions covering basic concepts, processes and facts covered over a one year course in biology. The pretest was given during the first week of school for both control and experimental groups. This pretest served as the covariate to equate differences on the posttest. The posttest was given during the first week of May for both control and experimental groups.

Control and experimental groups were also compared on six major tests (Appendix B). The average on the six tests for each student was the score from each student used in this comparison. The pretest mentioned above was used as the covariate to equate differences on students scores. The control group finished with the last of the six tests on February 25, 1988. The experimental group finished with

the last of the six tests on February 17, 1989.

Quasi-Experimental Design

The control group was taught by the teacher during the 1987-1988 school year. The experimental group was taught by this same teacher during the 1988-1989 school year. The control group was composed of the combined biology classes taught during the second, third, and fifth periods. The experimental group was composed of the combined biology classes taught during these same class periods. Control and experimental groups contained forty and forty two students, respectively.

In this two year study the researcher administered the same pretest to the control and experimental groups during the first week of school. The experimental group was given cooperative learning exercises from the beginning of the 1988-1989 school year until the end of the school year. The control group was taught using traditional methods such as lecture and teacher dominated discussions. The control group used no cooperative learning strategies during the 1987-1988 school year.

The experimental group gained thorough familiarity with the cooperative learning strategies from the first week in September. After thorough familiarity with the cooperative learning model, students were given six chapter tests to check for short term achievement. These tests were given between December 19, 1988 and February 17, 1989. These same tests were given to the control group between December 17, 1987 and February 25, 1988. The tests given both groups were chapters 12, 13, 15, 16, 17, and 18. The tests were covered in consecutive order. The reason the chapter 14 test was discounted was because the control group was not tested on

that chapter during the 1987-1988 school year. See Appendix B for an example of the type of test given. Test results were statistically compared. The Analysis of Covariance was the statistical method used. The pretest given both groups was used as the covariate to equate differences between groups on the dependent variable. It determined if there were significant differences between control and experimental groups at the .05 probability level.

The achievement test, used as the pretest at the beginning of the respective years, was given as a posttest to both groups during the first week of May of the respective years. The pretest was the covariate and equated differences on the posttest for initial differences on the pretest. It determined if there were significant differences between control and experimental groups at the .05 probability level.

A summary of the quasi-experimental design may be seen below.

SCHOOL YEAR	GROUP	PRETEST DATE	TREATMENT	SHORT TERM ACHIEVEMENT	POST TEST DATE	STATISTIC TO COMPARE
87-88	CON.	SEPT.10 1987	WHOLE SCHOOL YEAR (TRADITIONAL STRATEGIES)	DEC. 17 TO FEB.25	MAY 5 1988	ANACOVA
88-89	EXP.	SEPT.8 1988	WHOLE SCHOOL YEAR (COOP LEARN. MODEL)	DEC. 19 TO FEB. 17	MAY 3 1989	ANACOVA

Procedure

The same text, and tests were used by the control and experimental groups (Appendixes A and B).

Subjects in the experimental groups were given cooperative learning exercises centered around subject matter to be present on

each chapter test. Cooperative learning exercises were being offered as a student motivational device. The learning of subject matter was centered around these cooperative learning exercises.

Both long term and short term achievement tests were given to check for significant increases in achievement.

Control group students studied the same biology subject matter at school during the preceding year. They did not use cooperative learning exercises. They were taught by the same teacher who used a traditional approach of instruction that year, consisting of teacher controlled classroom discussions, followed by individual worksheets. Very little student to student interaction was stressed.

Both control and experimental groups were given laboratory investigations, audio video presentations, and homework assignments which were of the same nature. The cooperative learning model was not used by the control group, however, as they prepared for their chapter tests. They were given crossword puzzle worksheets and materials similar to the experimental group but all work in preparing for tests was done on an individual basis during class.

Statistical Hypotheses

The null hypotheses were used to test for differences in achievement between experimental and control groups. These hypotheses were:

1. There will be no significant difference in achievement between experimental and control groups over the short term as determined by the achievement test.

2. There will be no significant difference in achievement between experimental and control groups over the long term as determined by the achievement test.

Limitations

Random sampling of subjects was not possible since the groups were already formed. However, the covariate in the statistical analysis was used to equate group differences.

Existing control and experimental groups were taught during different years. Thus, environmental conditions may have produced differences between groups. However, this limitation may have decreased the external factor of the Hawthorne Effect.

This chapter explained the basic structure of the design. It described the specific aims of the study, the research hypotheses, subjects, instruments, quasi-experimental design, procedure, statistical hypotheses, and limitations.

CHAPTER IV

STATISTICAL ANALYSIS TO DETERMINE RELATIONSHIPS

Experimental Group

Correlations were determined for the fourteen coop learning groups in the whole experimental group on the six chapter tests. The Correlation Grid on page 28 was designed for convenience in comparing meaningful cooperative learning group data regarding four identified variables. The Pearson R (Produce Moment Correlation) was used to determine correlations. The App-Stat Statistical Package developed by Statsoft was used to perform this function.

The variable categories are listed below:

1. STAD group test average.
2. Individual with highest test score in group.
3. Individual test score average for group.
4. TGT group placement average for group.

Correlation output, regarding variables one to four, are found in Appendix E. The Correlation Grid on page 28 can be used to easily determine variables that did or did not show a positive relationship. The Grid on page 28 indicates important positive relationships between all of the variables except:

1. 2 and 4 = Individual with highest test score in group vs. TGT group placement average for group.

Interacting variables showing significant relationships are:

1. 1 and 2 = STAD group test average vs. individual with highest test score in group.

2. 1 and 3 = STAD group test average vs. individual test score average for group.

3. 1 and 4 = STAD group test average vs. TGT group placement average for group.

4. 2 and 3 = Individual with highest test score in group vs. individual test score average for group.

5. 3 AND 4 = Individual test score averages for group vs. TGT group placement average for group.

Specific scores for the fourteen cooperative learning groups in the experimental group may be found on the data file (Appendix F).

Numerical codes are given below the following Grid. Vertical and horizontal numbers on the Grid are matched to these codes. Used as coordinates, the numbers may determine if there are significant positive correlations between the identified variables. Since the .05 probability level was chosen to determine significance for the Pearson R statistic, a number smaller than .05 indicates a significant positive correlation. See Appendix E for coop correlation data.

CORRELATION GRID

	1	2	3	4
1	.0000	.0322	.0012	.0070
2	.0322	.0000	.0042	.6049
3	.0012	.0042	.0000	.0202
4	.0070	.6049	.0202	.0000

1 = STAD group test average.
2 = Individual with highest test score in group.
3 = Individual test score average for group.
4 = TGT group placement average for group.

Relationship Between Control and Experimental Groups

Averages for all students on six chapters were analyzed to check for a significant relationship between control and experimental groups. See the data table below.

AVERAGES FOR ALL STUDENTS ON SIX CHAPTERS

CHAPTER	CONTROL GROUP AVERAGES	EXPERIMENTAL GROUP AVERAGES
12	22.58	26.17
13	23.90	30.95
15	22.76	29.21
16	28.05	34.00
17	21.53	26.14
18	25.6	30.17

The Pearson R statistic was used to determine if there was a significant relationship between control and experimental groups. The .05 probability level was used to determine significance. The App-Stat Statistical package by Statsoft was used to perform this function. Correlation output may be found in Appendix E. Specific scores for the two variables may be found above and also on the data file on page 109.

The analysis determined that there was a significant positive relationship (.05 > p) between control and experimental groups on averages for the six chapter tests.

Correlation of Probability Levels Between Short Term and Long Term Items from the Analysis of Covariance

Short term achievement items (page 33) and long term achievement items (page 34) were compared using the Pearson R (Product Moment Correlation). Probability levels were the numbers used in comparing short term to long term items. Of the seventeen items, only one was in disagreement between the long term and short term findings regarding variable or group with the highest mean score. This was item number five. This item showed control group white females

as having a higher mean score on the dependent variable than experimental group white females. This difference, however, was not significant at the .05 probability level. Since item five showed this difference it was deleted from the comparison. Thus, the comparison was between the remaining sixteen short term and sixteen long term items. A detailed summary of this comparison is found in Appendix E. This analysis showed no relationship between the sixteen short term and sixteen long term items.

Summary of Cooperative Learning Relationships

The analysis showed that it may be possible to predict the success of cooperative learning groups as they perform. Past group performances in one area may be used to predict future group performances in another. This study showed that the highest individual test score in the group can be used to predict relative success on group tests and the average of the individual tests for the group. The study also showed that the group test average may be an indicator of relative success for that group regarding individual test score average and group competition placement average. It was also shown that group competition placement average may be used as an indicator of relative success on individual test score average for each group. There was no relationship between the individual with the highest test score in the group and the relative group competition placement average for that group. Thus, group test average is a better indicator of group competition placement average than is the highest individual test score in the group.

The six chapter tests used for measuring short term achievement were relatively difficult for both control and experimental groups.

CHAPTER V

STATISTICAL ANALYSES OF CONTROL AND EXPERIMENTAL GROUPS

Analysis of Covariance

The Analysis of Covariance (ANACOVA) was the statistic chosen to determine if significant differences between control and experimental groups existed on the dependent variables following the treatment. The following table is a summary of this statistical design.

ANACOVA STATISTICAL DESIGN

EFFECTS	VARIABLES ON DATA FILE		CODES	GROUPS
A	1	(Groups)	1	Control
			2	Experimental
B	2	(Race-Sex) combined	1	Black-Male
			2	Black-Female
			3	White-Male
			4	White-Female
C	6	(Sex)	1	Male
			2	Female
D	7	(Race)	1	Black
			2	White
Covariate	3		Pretest: 1987 Biology Nat. Sc. Olympiad	Individual Scores
Dependent Variable	4		Posttest:1987 Biology Nat. Sc. Olympiad	Individual Scores
Dependent Variable	5		Average stud. scores for 6 chapter tests	Individual Scores

The Covariate

The covariate, used to equate differences on the long term and short term dependent variables, was the 1987 Biology National Science Olympiad Achievement Test (Appendix B). The test contained forty multiple choice questions. It was given to both control and experimental groups during the first week of the 1987-1988 and 1988-1989 school years, respectively. This test also served as the posttest when checking for long term differences between control and experimental groups after each group had almost completed one school year of general biology. Both groups were one school month, about twenty days, from completing the coursework in the textbook.

The Achievement Tests

The achievement test used to check for short term achievement was the average student scores for six chapter tests (Appendix B). Each of these tests averaged forty five questions. The questions were matching, multiple choice, and true-false.

The achievement test used to check for long term achievement was the 1987 Biology National Science Olympiad Achievement Test.

Short Term Findings from the Analysis of Covariance

The data file with codes, used for short term analysis, can be found in Appendix F. This was the data gathered from the study. A detailed summary of the Analysis of Covariance findings can be found in Appendix C.

The data table on the following page can be used to determine where significant interactions occurred on a short term basis.

SHORT TERM INTERACTIONS

ITEM #	VARIABLES COMPARED (see codes below)	CONTROL COMPARED TO EXP.	CONTROL & EXP. GROUPS COMBINED	VARIABLE OR GROUP WITH Highest MEAN SCORE	SIGNIFICANT DIFFERENCE AT .05 LEVEL	PROB. LEVEL	PAGE #
1	I, II	YES	NO	EXPERIMENTAL	YES	.0001	
2	III	YES	NO	EXPERIMENTAL	YES	.0104	
3	IV	YES	NO	EXPERIMENTAL	YES	.0031	
4	V	YES	NO	EXPERIMENTAL	NO	.3381	
5	VI	YES	NO	EXPERIMENTAL	YES	.0230	
6	VII	YES	NO	EXPERIMENTAL	YES	.0330	
7	VIII	YES	NO	EXPERIMENTAL	YES	.0003	
8	IX	YES	NO	EXPERIMENTAL	YES	.0006	
9	X	YES	NO	EXPERIMENTAL	YES	.0134	
10	VII, VIII	NO	YES	VIII	NO	.3160	
11	IX, X	NO	YES	X	YES	.0015	
12	III, IV	NO	YES	IV	NO	.1060	
13	III, V	NO	YES	V	YES	.0027	
14	III, VI	NO	YES	VI	YES	.0032	
15	IV, V	NO	YES	V	NO	.1092	
16	IV, VI	NO	YES	VI	NO	.0970	
17	V, VI	NO	YES	VI	NO	.7683	

CODES

I = CONTROL GROUP
II = EXPERIMENTAL GROUP
III = BLACK-MALES
IV = BLACK-FEMALES
V = WHITE-MALES
VI = WHITE-FEMALES
VII = MALES
VIII = FEMALES
IX = BLACK STUDENTS
X = WHITE STUDENTS

Long Term Findings from the Analysis of Covariance

The data file with codes used for long term analysis can be found in Appendix F. This was the data gathered from the study. For a detailed summary of the ANACOVA findings see Appendix D.

The following data table can be used to determine where significant interactions occurred on a long term basis. Roman numeral codes are the same as for long term findings on the preceding page.

LONG TERM INTERACTIONS

ITEM #	VARIABLES COMPARED (see codes below)	CONTROL COMPARED TO EXP.	CONTROL & EXP. GROUPS COMBINED	VARIABLE OR GROUP WITH Highest MEAN SCORE	SIGNIFICANT DIFFERENCE AT .05 LEVEL	PROB. LEVEL	PAGE #
1	I, II	YES	NO	EXPERIMENTAL	NO	.2190	
2	III	YES	NO	EXPERIMENTAL	NO	.6316	
3	IV	YES	NO	EXPERIMENTAL	NO	.3595	
4	V	YES	NO	EXPERIMENTAL	NO	.2380	
5	VI	YES	NO	CONTROL	NO	.4416	
6	VII	YES	NO	EXPERIMENTAL	NO	.2190	
7	VIII	YES	NO	EXPERIMENTAL	NO	.7254	
8	IX	YES	NO	EXPERIMENTAL	NO	.3586	
9	X	YES	NO	EXPERIMENTAL	NO	.6266	
10	VII, VIII	NO	YES	VIII	NO	.2714	
11	IX, X	NO	YES	X	YES	.0123	
12	III, IV	NO	YES	IV	NO	.4585	
13	III, V	NO	YES	V	NO	.0827	
14	III, VI	NO	YES	VI	YES	.0206	
15	IV, V	NO	YES	V	NO	.2751	
16	IV, VI	NO	YES	VI	YES	.0508	
17	V, VI	NO	YES	VI	NO	.4172	

Summary of ANACOVA Findings

The experimental group using cooperative learning showed important increases in achievement over the control group that did not use cooperative learning. These significant increases in achievement were on short term chapter tests that focused on specific biology subject matter.

The experimental group did not show significant increases in achievement over the control group when measuring long term effects. A higher mean on the dependent variable, however, was produced by the experimental group. This higher mean measured achievement from the first week of September to the first week of May. This long term effect covered a large diversification of biology subject matter and was measured by a posttest given during the first week of May.

Experimental group black males showed a significant increase in achievement over control group black males over the short term. Experimental group black males had a higher mean on the dependent variable than control group black males over the long term. This difference, however, was not significant at the .05 level.

Other experimental groups showing significant increases over their counterparts in the control groups, over the short term, were: black females, white females, males, females, black students, and white students.

Experimental group white males had a higher mean than control group white males, over the short term, but the difference in mean scores was not significant.

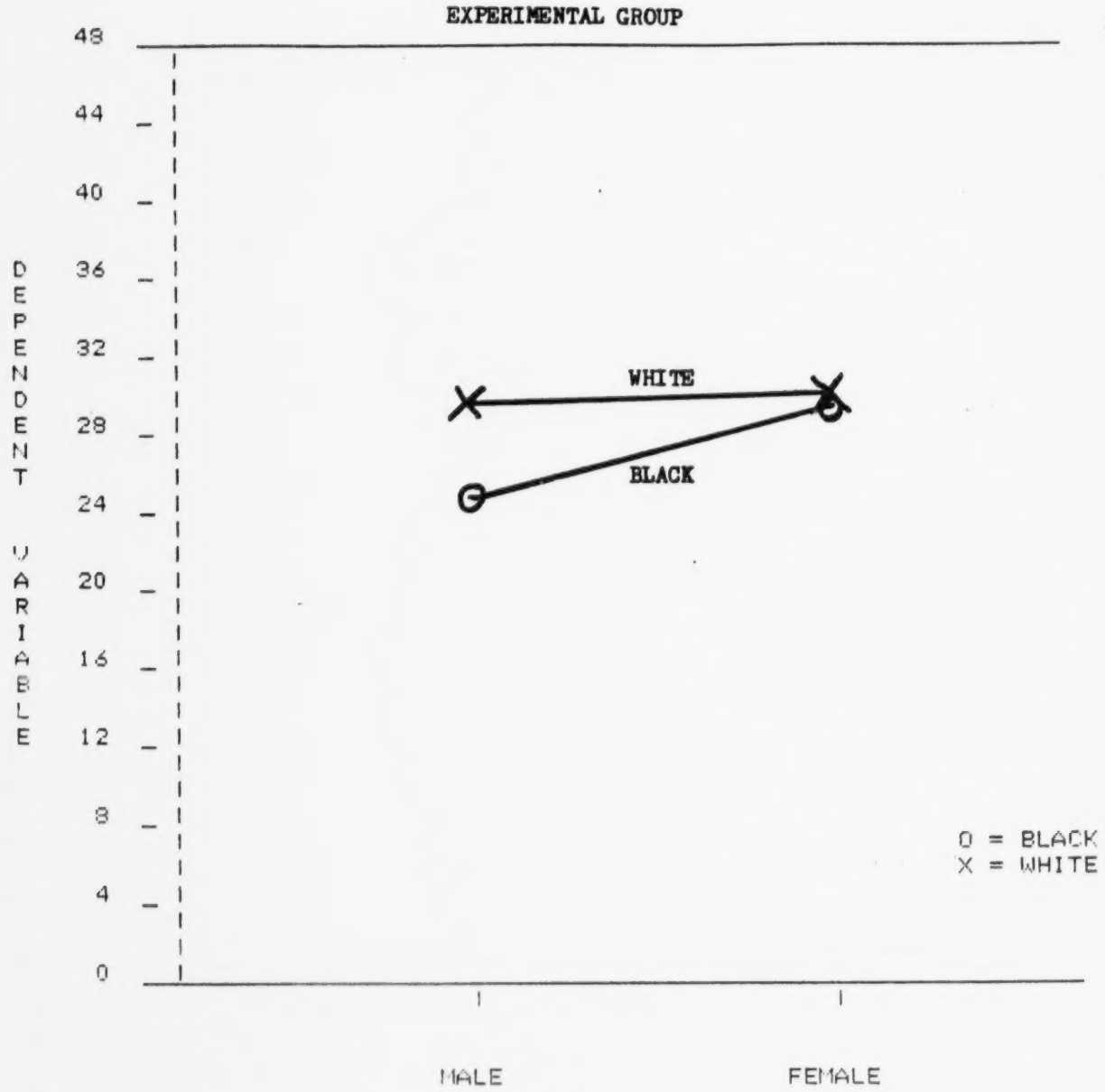
Of the above groups showing significant increases in achievement, over the short term, the most significant increases, in order, were

found between control and experimental groups, control and experimental females, and control and experimental black students.

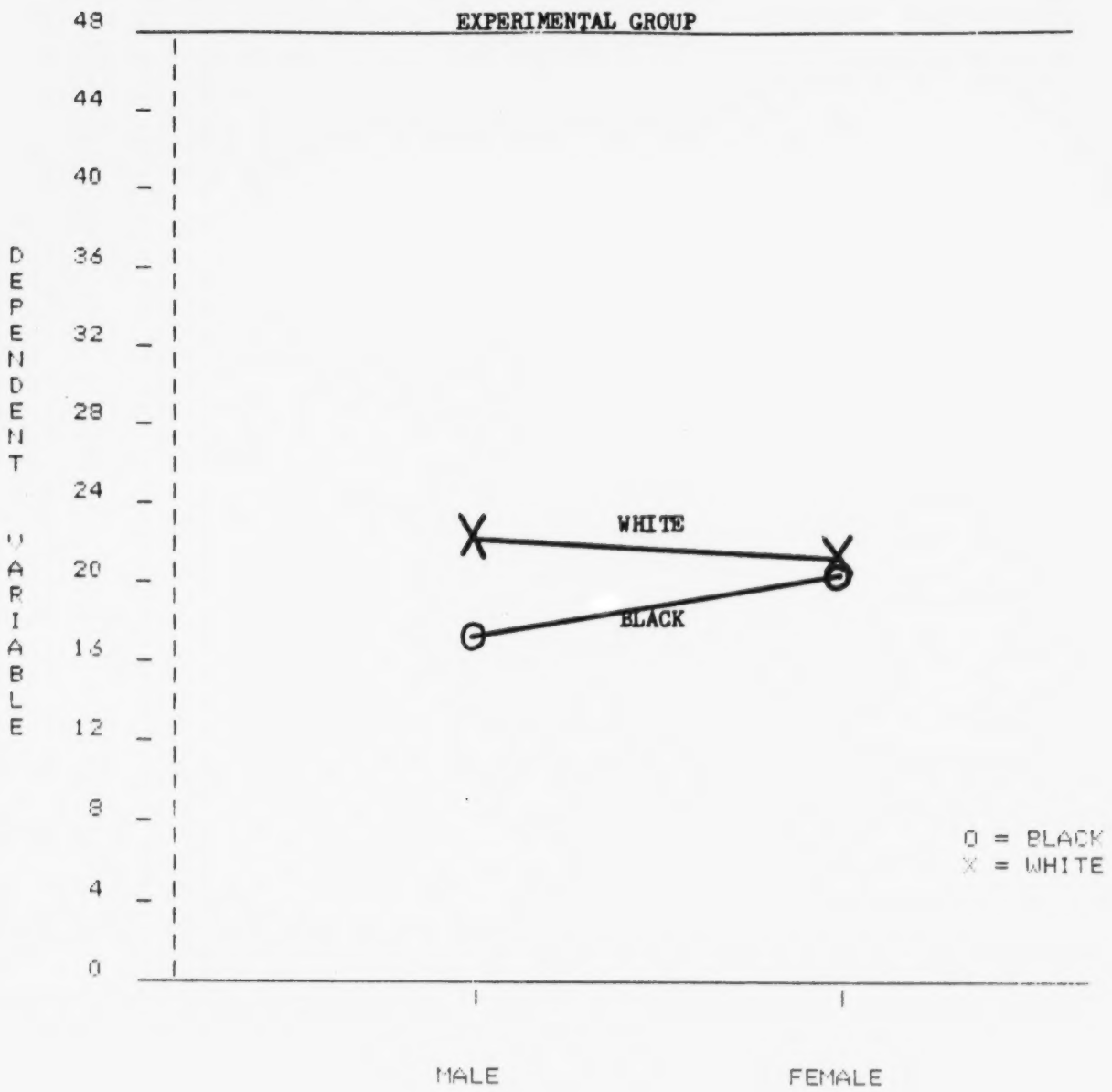
Over the long term all experimental groups, except one, had higher mean scores on the dependent variable than their control group counterparts. However, these higher averages were insignificant at the .05 probability level. White females were the only group that had a higher control group mean. This difference was not significant, however, and may have been due to maturity, since the control group was taught on a traditional basis, which may have favored the more mature student.

See trend lines for short term and long term achievement on the following two pages.

TREND LINES FOR SHORT TERM ACHIEVEMENT ON THE DEPENDENT VARIABLE ADJUSTED FOR THE COVARIATE



TREND LINES FOR LONG TERM ACHIEVEMENT ON THE DEPENDENT VARIABLE ADJUSTED FOR THE COVARIATE



CHAPTER VI

SUMMARY, CONCLUSIONS, IMPLICATIONS, RECOMMENDATIONS TO IMPROVE STUDY, AND SUGGESTIONS FOR FURTHER STUDY

Summary

This study was designed to investigate the effects of cooperative learning exercises on the achievement of ninth grade multi-cultural biology classes.

The study was conducted during a two year period. The control group was taught from September 10, 1987 to May 5, 1988. The experimental group was taught from September 8, 1988 to May 5, 1989. The same teacher taught both groups at the same junior high school in the Alexandria City, Virginia School District. The size of the junior high school was approximately nine hundred students. The School District had a total enrollment of approximately nine thousand two hundred students. The school system was multi-cultural with about forty per-cent various other ethnic groups. There were two junior high schools housing seventh, eighth, and ninth graders. The high school educated tenth, eleventh, and twelfth grade students.

The control group sample consisted of forty students in three classes of ninth grade biology. The experimental group consisted of forty two students in three classes of ninth grade biology that were taught at exactly the same times during the day as the control group. The instructor was a white male with over twenty five years of experience teaching biology and other science courses in the state of Virginia.

A cooperative learning model was used by the experimental group

as the treatment. This model was used to prepare students for each chapter test. The model was three consecutive days in a cycle consisting of a group quiz, group competition, and culminating with an individual test on the third day. The control group did not use the model and was taught using traditional methods involving very little group activity.

The researcher administered the appropriate pretest to both control and experimental groups. This pretest was used as a covariate to equate differences on posttest data.

Short term effects were measured by students average scores on six standardized chapter tests. Long term effects were determined by repeating the pretest measure as the posttest.

The statistical analysis design was the Analysis of Covariance. The pretest covariate in this design equated posttest scores for initial differences on the pretest. The .05 probability level was used to determine where significant interactions occurred. Several ANACOVA analyses were performed. The factors investigated were groups (control and experimental), sex (male and female), and race (black and white). The design indicated significant increases of experimental group students over control group students on the short term dependent variable. It also indicated the following significant increases of subgroups, within the experimental group, over their counterparts in the control group:

1. Black-Males,
2. Black-Females,
3. White-Females,
4. Males,
5. Females,

6. Black students,

7. White students.

The design indicated no significant increases between control and experimental groups on the long term dependent variable. However, the experimental group and subgroups had higher mean scores in eight of the nine categories investigated. Thus, the experimental group and subgroups within the experimental group were much more successful than the control group over the long term regarding the frequency of higher mean scores on the dependent variable.

The Product Moment Correlation (Pearson R) was used to determine cooperative learning group relationships. The fourteen cooperative learning groups in the experimental group were compared for relationships regarding the following variables:

1. STAD group test average,
2. Individual with highest test scores in group,
3. Individual test score average for group,
4. TGT group placement average for group.

The analyses showed that the highest individual test score in the group can be used to predict success on group tests and average of the individual tests for the group. Group test average was also related to individual test score average and group competition placement average. Group competition placement average was also related to success on individual test score average for each group. Group test average was a better indicator of group competition placement than was the highest individual test score in the group. These analyses showed that past group performance in one area may be used to predict future group performance in another.

Both control and experimental groups showed a positive relation-

ship regarding the difficulty of the six chapter tests used for measuring short term achievement.

The following generalizations (conclusions) refer to the students enrolled in biology in the secondary schools of the Alexandria City, Virginia School System. It is possible to conceive of the results of this experiment as applicable to the population of secondary school students taking biology in the ninth grade in similar school districts.

Conclusions

The following conclusions were made from the analyses of data collected from the ninth grade biology classes achievements during this quasi-experimental study:

1. The experimental group, receiving cooperative learning exercises, showed a significant increase in achievement over the control group on the dependent variable over the short term.

2. There was no significant difference in achievement between control and experimental groups on the dependent variable over the long term.

The cooperative learning model was more successful over the short term than over the long term. However, the experimental group and subgroups within the experimental group were much more successful than the control group regarding the frequency of higher mean scores on the posttest over the long term.

It is possible to predict the success of cooperative learning groups by observing past group performances.

The researcher was able to implement the effect of sign language lessons in the process of teaching ninth grade biology classes without incurring additional expenses or requiring special facilities.

Implications

The experimental group showed a significant increase in achievement over the control group at the .0001 level when measuring the effects of the cooperative learning model on a short term basis. This indicated that cooperative learning exercises were responsible for significant increases in achievement on short term chapter tests in ninth grade biology in a junior high school in the Alexandria City, Virginia School District.

Both black males and black females in the experimental group showed significant increases in achievement, at the .01 and .0031 levels, over their counterparts in the control group when measuring short term effects of the cooperative learning model. This indicated that the cooperative learning model had the positive effect of producing significant increases in achievement for black students on short term items such as chapter tests.

Black students and white students in the experimental group both showed significant increases in achievement over their control group counterparts over the short term. Black students showed increases at the .0006 probability level and white students did significantly better at the .0134 level. This indicated that both black students and white students improved significantly on chapter tests but black students achieved more and were actually gaining on their white peers.

Over the long term, the experimental group showed no significant improvement over the control group but did have a higher mean score on the posttest. Seven of the eight experimental subgroups plus the experimental group had higher mean scores. Thus, the frequency of higher mean scores was much greater over the long term for the experiment-

al groups. This indicated a consistent improvement in achievement over the long term for students using the cooperative learning model. Long term achievement, however, improves much more slowly than short term achievement.

This study showed that positive relationships existed between the fourteen cooperative learning groups in the experimental group and the variables found on the correlation grid on page 28. This indicated that past cooperative group performance in one area may be used to predict future group performance in another. It indicated that it is important to have one high achiever in each cooperative group.

Overall, this study indicated that the cooperative learning model, if used correctly, is much more effective and efficient than using traditional approaches with general biology students in a multi-cultural environment.

Recommendations to Improve the Study

1. Control groups and experimental groups could be taught during the same school year. However, it would be much more difficult for the same teacher to handle both experimental and control groups during the same year. This would also make it more difficult to control the Hawthorne Effect.

2. Control and Experimental groups could be randomly selected instead of using existing groups.

3. Rewards other than group competition placements and grades could be given to motivate students.

Suggestions for Further Study

1. A similar study could be conducted with both control groups and experimental groups being taught during the same school year.

2. A similar study could be conducted using random sampling of subjects into control and experimental groups.

3. A similar study could be conducted, using other courses, since effectiveness of cooperative learning exercises may depend on the educational environment, regarding subject matter.

4. A similar study could be conducted using other grade levels, since effectiveness of the cooperative learning model may depend on the maturity level of students.

5. A similar study could be conducted using rewards other than group competition and placement group grades to motivate students.

6. A similar study could be conducted in a non-multi cultural environment.

APPENDIX A

TEXTBOOK AND TEAM SUMMARY SHEET USED IN THE STUDY

THE CONTROL AND EXPERIMENTAL CLASSES PARTICIPATING IN THIS STUDY USED THE FOLLOWING TEXTBOOK:

Oram, Raymond F.; Hummer, Paul J.; Smoot, Robert C. Biology, Living Systems . Columbus, Ohio: Charles E. Merrill Publishing Company, 1983.

Team Summary Sheet

Team Name: _____

Team Members	1	2	3	4	5	6	7	8	9
Total Team Score									
Team Average									
Team Award (super, great, good)									

APPENDIX B

SHORT TERM AND LONG TERM ACHIEVEMENT TESTS

Appendix B contains copyrighted material and has been pulled.

APPENDIX C

SHORT TERM ACHIEVEMENT TEST DATA

A N A L Y S I S O F V A R I A N C E

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:1 2 3 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	212.977768	1	212.977768	7.73749985	.0069
A	588.388841	1	588.388841	21.3762151	.0009
B	378.067634	3	126.022545	4.57840944	.0056
A x B	86.4959672	3	28.8319891	1.04746854	.3776
WITHIN	2009.3541	73	27.5253986		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	18.7571429	2.86254382	7
	* 2	22.06	4.33499449	10
	* 3	27.8230769	5.64288978	13
	* 4	24.901	5.06671365	10
2	* 1	24.2114286	6.16766417	7
	* 2	30.3328571	4.6108774	7
	* 3	29.62	5.57261688	11
	* 4	30.4223529	6.72934027	17

Mean for entire sample:26.67[illegible]537 Standard Deviation:6.4722 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	14.5714286	2.50713266	7
	* 2	14.5	3.59783886	10
	* 3	16	3.21455024	13
	* 4	14.2	3.64539284	10
2	* 1	12	3.65148371	7
	* 2	15.2857143	3.54562103	7
	* 3	14.9090909	2.98176274	11
	* 4	14.1176471	3.10004744	17

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 1	18.7391188
	* 2	22.0789252
	* 3	27.0660685
	* 4	25.075112
2	* 1	25.5235766
	* 2	29.9453409
	* 3	29.4273069
	* 4	30.6390652

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUPS

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	370.686989	1	370.686989	11.7602156	.0013
A	632.264197	1	632.264197	20.0588731	.0001
WITHIN	2490.11354	79	31.5204245		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	MEAN	STDV	N
1	24.06525	5.68274213	40
2	29.1621429	6.24958865	42

Mean for entire sample:26.6758537 Standard Deviation:6.4722 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	MEAN	STDV	N
1	14.925	3.2846769	40
2	14.1666667	3.29757237	42

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	ADJUSTED MEAN
1	23.8112184
2	29.4040778

A N A L Y S I S O F V A R I A N C E

CONTROL AND EXPERIMENTAL GROUP BLACK MALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:1

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	80.8421907	1	80.8421907	4.52406126	.0546
A	168.290531	1	168.290531	9.41781349	.0104
B	0	0			
A x B	0	0			
WITHIN	196.563231	11	17.8693846		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	18.7571429	2.86254382	7
2	* 1	24.2114286	6.16766417	7

Mean for entire sample:21.4842857 Standard Deviation:5.41740596 N:14

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	14.5714286	2.50713266	7
2	* 1	12	3.65148371	7

Mean for entire sample:13.2857143 Standard Deviation:3.29168116 N:14

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 1	17.691654
2	* 1	25.2769175

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP BLACK FEMALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	2.80541258	1	2.80541258	.133643205	.7183
A	271.778166	1	271.778166	12.9468676	.0031
B	0	0			
A x B	0	0			
WITHIN	293.885321	14	20.9918087		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 2	22.06	4.33499449	10
2	* 2	30.3328571	4.6108774	7

Mean for entire sample:25.4664706 Standard Deviation:6.01302325 N:17

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 2	14.5	3.59783886	10
2	* 2	15.2857143	3.54562103	7

Mean for entire sample:14.8235294 Standard Deviation:3.48631778 N:17

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 2	22.0991149
2	* 2	30.2769787

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP WHITE MALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:3

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	41.9350853	1	41.9350853	1.35334342	.2567
A	30.0037019	1	30.0037019	.968289734	.3381
B	0	0			
A x B	0	0			
WITHIN	650.71199	21	30.9862852		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 3	27.8230769	5.64288978	13
2	* 3	29.62	5.57261688	11

Mean for entire sample:28.6466667 Standard Deviation:5.[illegible]34136 N:24

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 3	16	3.21455024	13
2	* 3	14.9090909	2.98176274	11

Mean for entire sample:15.5 Standard Deviation:3.09276853 N:24

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 3	27.6011747
2	* 3	29.8822481

A N A L Y S I S O F V A R I A N C E

CONTROL AND EXPERIMENTAL GROUP WHITE FEMALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	141.209721	1	141.209721	4.16149477	.0498
A	196.05145	1	196.05145	5.77769772	.0230
B	0	0			
A x B	0	0			
WITHIN	814.378848	24	33.932452		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 4	24.901	5.06671365	10
2	* 4	30.4223529	6.72934027	17

Mean for entire sample:28.3774074 Standard Deviation:6.64348522 N:27

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 4	14.2	3.64539284	10
2	* 4	14.1176471	3.10004744	17

Mean for entire sample:14.1481481 Standard Deviation:3.24278728 N:27

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 4	24.8637329
2	* 4	30.4442748

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP MALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR6 CODES:1

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	269.33542	1	269.33542	7.85677398	.0080
A	164.82064	1	164.82064	4.80797703	.0330
B	0	0			
A x B	0	0			
WITHIN	1199.8232	35	34.2806629		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 1	24.65	6.510078	20
2	* 1	27.5166667	6.24931707	18

Mean for entire sample:26.0078947 Standard Deviation:6.46615148 N:38

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 1	15.5	2.99999998	20
2	* 1	13.7777778	3.47352262	18

Mean for entire sample:14.6842105 Standard Deviation:3.30523956 N:38

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (6)	ADJUSTED MEAN
1	* 1	23.9596541
2	* 1	28.2837177

A N A L Y S I S O F V A R I A N C E

CONTROL AND EXPERIMENTAL GROUP FEMALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR6 CODES:2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	97.7359395	1	97.7359395	3.35345312	.0709
A	514.20843	1	514.20843	17.6431911	.0003
B	0	0			
A x B	0	0			
WITHIN	1194.93948	41	29.1448653		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 2	23.4805	4.81516408	20
2	* 2	30.39625	6.08685374	24

Mean for entire sample:27.2527273 Standard Deviation:6.49585025 N:44

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 2	14.35	3.52845574	20
2	* 2	14.4583333	3.2029764	24

Mean for entire sample:14.4090909 Standard Deviation:3.31534963 N:44

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (6)	ADJUSTED MEAN
1	* 2	23.5073747
2	* 2	30.3738544

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP BLACK STUDENTS

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR7 CODES:1

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	104.097715	1	104.097715	4.51149398	.0403
A	375.861686	1	375.861686	16.2894809	.0006
B	0	0			
A x B	0	0			
WITHIN	646.068914	28	23.0738898		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 1	20.7	4.05596321	17
2	* 1	27.2721429	6.12028922	14

Mean for entire sample:23.6680645 Standard Deviation:6.00493652 N:31

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 1	14.5294118	3.10478756	17
2	* 1	13.6428571	3.85520913	14

Mean for entire sample:14.1290323 Standard Deviation:3.43260769 N:31

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (7)	ADJUSTED MEAN
1	* 1	20.4808474
2	* 1	27.5382567

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP WHITE STUDENTS

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3
MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR7 CODES:2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	196.830323	1	196.830323	6.28196046	.0149
A	203.485906	1	203.485906	6.49437747	.0134
B	0	0			
A x B	0	0			
WITHIN	1503.96609	48	31.3326268		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 2	26.5526087	5.48308161	23
2	* 2	30.1071429	6.2044917	28

Mean for entire sample:28.5041177 Standard Deviation:6.09973873 N:51

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 2	15.2173913	3.4503823	23
2	* 2	14.4285714	3.02371576	28

Mean for entire sample:14.7843137 Standard Deviation:3.21442824 N:51

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (7)	ADJUSTED MEAN
1	* 2	26.2832377
2	* 2	30.3284119

ANALYSIS OF VARIANCE

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 2 3 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	169.552977	1	169.552977	4.92682439	.0276
A	472.480311	3	157.493437	4.57640154	.0055
WITHIN	2649.89742	77	34.4142523		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
1	21.4842857	5.41740596	14
2	25.4664706	6.01302325	17
3	28.6466667	5.5634136	24
4	28.3774074	6.64348522	27

Mean for entire sample:26.6758537 Standard Deviation:6.4722 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
2	14.8235294	3.48631778	17
3	15.5	3.09276853	24
4	14.1481481	3.24278728	27

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	22.0500785
2	25.3366804
3	28.2108959
4	28.553105

ANALYSIS OF VARIANCE

MALES AND FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR6 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	278.959856	1	278.959856	7.14937681	.0089
A	39.8952679	1	39.8952679	1.02246361	.3160
WITHIN	3082.48247	79	39.0187654		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (6)	MEAN	STDV	N
1	26.0078947	6.46615148	38
2	27.2527273	6.49585025	44

Mean for entire sample:26.6758537 Standard Deviation:6.4722 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (6)	MEAN	STDV	N
1	14.6842105	3.30523956	38
2	14.4090909	3.31534963	44

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (6)	ADJUSTED MEAN
1	25.9246284
2	27.3246391

A N A L Y S I S O F V A R I A N C E

BLACK STUDENTS AND WHITE STUDENTS WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR7 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	209.049481	1	209.049481	6.04262412	.0153
A	389.308678	1	389.308678	11.2530583	.0015
WITHIN	2733.06906	79	34.5958108		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (7)	MEAN	STDV	N
1	23.6680645	6.00493652	31
2	28.5041177	6.09973873	51

Mean for entire sample:26.6758537 Standard Deviation:6.4722 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (7)	MEAN	STDV	N
1	14.1290323	3.43260769	31
2	14.7843137	3.21442824	51

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (7)	ADJUSTED MEAN
1	23.8678304
2	28.3826913

ANALYSIS OF VARIANCE

BLACK MALES AND BLACK FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	28.8938615	1	28.8938615	.868860398	.3620
A	90.7935361	1	90.7935361	2.73023071	.1060
WITHIN	931.137065	28	33.2548952		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
1	21.4842857	5.41740596	14
2	25.4664706	6.01302325	17

Mean for entire sample:23.6680645 Standard Deviation:6.00493652 N:31

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
2	14.8235294	3.48631778	17

Mean for entire sample:14.1290323 Standard Deviation:3.43260769 N:31

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	21.7318337
2	25.2626075

ANALYSIS OF VARIANCE

BLACK MALES AND WHITE MALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 3

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	47.7545358	1	47.7545358	1.59842566	.2121
A	318.984483	1	318.984483	10.676954	.0027
WITHIN	1045.65936	35	29.8759817		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
1	21.4842857	5.41740596	14
3	28.6466667	5.5634136	24

Mean for entire sample:26.0078947 Standard Deviation:6.46615148 N:38

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
3	15.5	3.09276853	24

Mean for entire sample:14.6842105 Standard Deviation:3.30523956 N:38

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	21.9930317
3	28.3498982

ANALYSIS OF VARIANCE

BLACK MALES AND WHITE FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	141.454193	1	141.454193	3.87376234	.0534
A	370.22504	1	370.22504	10.1387155	.0032
WITHIN	1387.6069	38	36.515971		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
1	21.4842857	5.41740596	14
4	28.3774074	6.64348522	27

Mean for entire sample:26.0236585 Standard Deviation:7.01271592 N:41

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
4	14.1481481	3.24278728	27

Mean for entire sample:13.8536585 Standard Deviation:3.24469544 N:41

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	21.8161609
4	28.205324

ANALYSIS OF VARIANCE

BLACK FEMALES AND WHITE MALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:2 3

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	42.5370958	1	42.5370958	1.29535341	.2612
A	86.4441252	1	86.4441252	2.63242448	.1092
WITHIN	1247.85223	38	32.8382166		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
2	25.4664706	6.01302325	17
3	28.6466667	5.5634136	24

Mean for entire sample:27.3280488 Standard Deviation:5.89710194 N:41

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
2	14.8235294	3.48631778	17
3	15.5	3.09276853	24

Mean for entire sample:15.2195122 Standard Deviation:3.23660465 N:41

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
2	25.5933273
3	28.5568099

A N A L Y S I S O F V A R I A N C E

BLACK FEMALES AND WHITE FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:2 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	126.808942	1	126.808942	3.25104873	.0752
A	109.920382	1	109.920382	2.81807034	.0970
WITHIN	1599.22753	41	39.0055494		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
2	25.4664706	6.01302325	17
4	28.3774074	6.64348522	27

Mean for entire sample:27.2527273 Standard Deviation:6.49585025 N:44

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
2	14.8235294	3.48631778	17
4	14.1481481	3.24278728	27

Mean for entire sample:14.4090909 Standard Deviation:3.31534963 N:44

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
2	25.2507117
4	28.5132556

ANALYSIS OF VARIANCE

WHITE MALES AND WHITE FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:5 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:3 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	154.858297	1	154.858297	4.3607695	.0396
A	2.89084284	1	2.89084284	.0814053848	.7683
WITHIN	1704.56115	48	35.5116906		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 5):

CODES VAR (2)	MEAN	STDV	N
3	28.6466667	5.5634136	24
4	28.3774074	6.64348522	27

Mean for entire sample:28.5041177 Standard Deviation:6.09973873 N:51

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
3	15.5	3.09276853	24
4	14.1481481	3.24278728	27

Mean for entire sample:14.7843137 Standard Deviation:3.21442824 N:51

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
3	28.2457196
4	28.7338049

APPENDIX D

LONG TERM ACHIEVEMENT TEST DATA

ANALYSIS OF VARIANCE

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:1 2 3 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	315.672984	1	315.672984	11.8984183	.0012
A	30.6310492	1	30.6310492	1.15455251	.2860
B	211.443639	3	70.4812128	2.656594	.0536
A x B	65.9342837	3	21.9780946	.828403368	.4851
WITHIN	1936.73875	73	26.5306678		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	16.7142857	7.15807903	7
	* 2	18.2	4.82585629	10
	* 3	20.3846154	6.04894565	13
	* 4	22.7	5.3343749	10
2	* 1	16.8571429	6.89029685	7
	* 2	20.8571429	5.14550198	7
	* 3	22.4545455	3.64317544	11
	* 4	21.1176471	5.38379918	17

Mean for entire sample:20.2560976 Standard Deviation:5.65644167 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	14.5714286	2.50713266	7
	* 2	14.5	3.59783886	10
	* 3	16	3.21455024	13
	* 4	14.2	3.64539284	10
2	* 1	12	3.65148371	7
	* 2	15.2857143	3.54562103	7
	* 3	14.9090909	2.98176274	11
	* 4	14.1176471	3.10004744	17

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 1	16.6923424
	* 2	18.2230405
	* 3	19.4629945
	* 4	22.9119728
2	* 1	18.4546191
	* 2	20.3853607
	* 3	22.219951
	* 4	21.3814836

A N A L Y S I S O F V A R I A N C E

CONTROL AND EXPERIMENTAL GROUPS

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	383.276388	1	383.276388	13.8242474	.0006
A	42.123744	1	42.123744	1.51934499	.2190
WITHIN	2190.27002	79	27.7249369		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	MEAN	STDV	N
1	19.775	5.97639587	40
2	20.7142857	5.36604367	42

Mean for entire sample:20.2560976 Standard Deviation:5.65644167 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	MEAN	STDV	N
1	14.925	3.2846769	40
2	14.1666667	3.29757237	42

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	ADJUSTED MEAN
1	19.5166906
2	20.9602947

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP BLACK MALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:1

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	63.0390082	1	63.0390082	1.310219	.2764
A	11.9896023	1	11.9896023	.249194985	.6316
B	0	0			
A x B	0	0			
WITHIN	529.246707	11	48.113337		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	16.7142857	7.15807903	7
2	* 1	16.8571429	6.89029685	7

Mean for entire sample:16.7857143 Standard Deviation:6.75025438 N:14

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 1	14.5714286	2.50713266	7
2	* 1	12	3.65148371	7

Mean for entire sample:13.2857143 Standard Deviation:3.29168116 N:14

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 1	15.773405
2	* 1	17.7980236

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP BLACK FEMALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	64.5266632	1	64.5266632	2.97230242	.1036
A	19.6968641	1	19.6968641	.907299927	.3595
B	0	0			
A x B	0	0			
WITHIN	303.930475	14	21.7093196		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 2	18.2	4.82585629	10
2	* 2	20.8571429	5.14550198	7

Mean for entire sample:19.2941176 Standard Deviation:4.98453488 N:17

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 2	14.5	3.59783886	10
2	* 2	15.2857143	3.54562103	7

Mean for entire sample:14.8235294 Standard Deviation:3.48631778 N:17

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 2	18.3875917
2	* 2	20.5891548

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP WHITE MALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:3

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	39.2840629	1	39.2840629	1.54917206	.2251
A	37.1586544	1	37.1586544	1.46535631	.2380
B	0	0			
A x B	0	0			
WITHIN	532.520138	21	25.3581018		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 3	20.3846154	6.04894565	13
2	* 3	22.4545455	3.64317544	11

Mean for entire sample:21.3333333 Standard Deviation:5.09617648 N:24

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 3	16	3.21455024	13
2	* 3	14.9090909	2.98176274	11

Mean for entire sample:15.5 Standard Deviation:3.09276853 N:24

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 3	20.1698417
2	* 3	22.7083689

A N A L Y S I S O F V A R I A N C E

CONTROL AND EXPERIMENTAL GROUP WHITE FEMALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR2 CODES:4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	164.976561	1	164.976561	7.13555971	.0128
A	14.5136404	1	14.5136404	.627743403	.4416
B	0	0			
A x B	0	0			
WITHIN	554.888142	24	23.1203392		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 4	22.7	5.3343749	10
2	* 4	21.1176471	5.38379918	17

Mean for entire sample:21.7037037 Standard Deviation:5.3191585 N:27

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (2)	MEAN	STDV	N
1	* 4	14.2	3.64539284	10
2	* 4	14.1176471	3.10004744	17

Mean for entire sample:14.1481481 Standard Deviation:3.24278728 N:27

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (2)	ADJUSTED MEAN
1	* 4	22.6597186
2	* 4	21.141342

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP MALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR6 CODES:1

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	195.424262	1	195.424262	5.87622555	.0195
A	51.5907515	1	51.5907515	1.55128585	.2190
B	0	0			
A x B	0	0			
WITHIN	1163.98684	35	33.2567667		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 1	19.1	6.52041328	20
2	* 1	20.2777778	5.69628934	18

Mean for entire sample:19.6578947 Standard Deviation:6.09064994 N:38

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 1	15.5	2.99999998	20
2	* 1	13.7777778	3.47352262	18

Mean for entire sample:14.6842105 Standard Deviation:3.30523956 N:38

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (6)	ADJUSTED MEAN
1	* 1	18.5119568
2	* 1	20.9311592

A N A L Y S I S O F V A R I A N C E

CONTROL AND EXPERIMENTAL GROUP FEMALES

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR6 CODES:2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	210.518839	1	210.518839	8.81291099	.0051
A	2.94171825	1	2.94171825	.123148604	.7254
B	0	0			
A x B	0	0			
WITHIN	979.389488	41	23.8875485		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 2	20.45	5.4625519	20
2	* 2	21.0416667	5.204339	24

Mean for entire sample:20.7727273 Standard Deviation:5.26888026 N:44

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (6)	MEAN	STDV	N
1	* 2	14.35	3.52845574	20
2	* 2	14.4583333	3.2029764	24

Mean for entire sample:14.4090909 Standard Deviation:3.31534963 N:44

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (6)	ADJUSTED MEAN
1	* 2	20.4894422
2	* 2	21.0087982

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP BLACK STUDENTS

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR7 CODES:1

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	169.938088	1	169.938088	5.55941198	.0241
A	26.9257359	1	26.9257359	.880857614	.3586
B	0	0			
A x B	0	0			
WITHIN	855.893839	28	30.5676371		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 1	17.5882353	5.73431363	17
2	* 1	18.8571429	6.19996454	14

Mean for entire sample:18.1612903 Standard Deviation:5.88272483 N:31

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 1	14.5294118	3.10478756	17
2	* 1	13.6428571	3.85520913	14

Mean for entire sample:14.1290323 Standard Deviation:3.43260769 N:31

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (7)	ADJUSTED MEAN
1	* 1	17.3082267
2	* 1	19.1971533

ANALYSIS OF VARIANCE

CONTROL AND EXPERIMENTAL GROUP WHITE STUDENTS

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR1 CODES:1 2
Independent variable (B): VAR7 CODES:2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	162.269858	1	162.269858	6.64792377	.0125
A	6.04193685	1	6.04193685	.247528014	.6266
B	0	0			
A * B	0	0			
WITHIN	1171.63696	48	24.4091033		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 2	21.3913044	5.74249808	23
2	* 2	21.6428571	4.74704028	28

Mean for entire sample:21.5294118 Standard Deviation:5.16663501 N:51

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (1)	* VAR (7)	MEAN	STDV	N
1	* 2	15.2173913	3.4503823	23
2	* 2	14.4285714	3.02371576	28

Mean for entire sample:14.7843137 Standard Deviation:3.21442824 N:51

Adjusted Means (adjusted for Covariate):

CODES VAR (1)	* VAR (7)	ADJUSTED MEAN
1	* 2	21.1467227
2	* 2	21.8437635

ANALYSIS OF VARIANCE

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 2 3 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	296.767064	1	296.767064	11.2784473	.0015
A	206.311331	3	68.7704438	2.61357786	.0561
WITHIN	2026.08243	77	26.3127588		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
1	16.7857143	6.75025438	14
2	19.2941176	4.98453488	17
3	21.3333333	5.09617648	24
4	21.7037037	5.3191585	27

Mean for entire sample:20.2560976 Standard Deviation:5.65644167 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
2	14.8235294	3.48631778	17
3	15.5	3.09276853	24
4	14.1481481	3.24278728	27

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	17.53425
2	19.122407
3	20.7568149
4	21.936149

ANALYSIS OF VARIANCE

MALES AND FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR6 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	367.917938	1	367.917938	13.221443	.0007
A	34.0318187	1	34.0318187	1.22296226	.2714
WITHIN	2198.36194	79	27.8273664		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (6)	MEAN	STDV	N
1	19.6578947	6.09064994	38
2	20.7727273	5.26888026	44

Mean for entire sample:20.2560976 Standard Deviation:5.65644167 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (6)	MEAN	STDV	N
1	14.6842105	3.30523956	38
2	14.4090909	3.31534963	44

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (6)	ADJUSTED MEAN
1	19.5622692
2	20.855313

A N A L Y S I S O F V A R I A N C E

BLACK STUDENTS AND WHITE STUDENTS WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR7 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	309.78356	1	309.78356	11.8621072	.0012
A	169.277915	1	169.277915	6.48192165	.0123
WITHIN	2063.11584	79	26.1153904		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (7)	MEAN	STDV	N
1	18.1612903	5.88272483	31
2	21.5294118	5.16663501	51

Mean for entire sample:20.2560976 Standard Deviation:5.65644167 N:82

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (7)	MEAN	STDV	N
1	14.1290323	3.43260769	31
2	14.7843137	3.21442824	51

Mean for entire sample:14.5365854 Standard Deviation:3.29307209 N:82

Adjusted Means (adjusted for Covariate):

CODES VAR (7)	ADJUSTED MEAN
1	18.4044693
2	21.3815971

ANALYSIS OF VARIANCE

BLACK MALES AND BLACK FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 2

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	125.006846	1	125.006846	4.04702721	.0512
A	17.9398722	1	17.9398722	.580793397	.4585
WITHIN	864.879703	28	30.8885608		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
1	16.7857143	6.75025438	14
2	19.2941176	4.98453488	17

Mean for entire sample:18.1612903 Standard Deviation:5.88272483 N:31

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
2	14.8235294	3.48631778	17

Mean for entire sample:14.1290323 Standard Deviation:3.43260769 N:31

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	17.300615
2	18.8700817

A N A L Y S I S O F V A R I A N C E

BLACK MALES AND WHITE MALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 3

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	73.498475	1	73.498475	2.30466322	.1343
A	99.3855988	1	99.3855988	3.11639574	.0827
WITHIN	1116.19199	35	31.8911997		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
1	16.7857143	6.75025438	14
3	21.3333333	5.09617648	24

Mean for entire sample:19.6578947 Standard Deviation:6.09064994 N:38

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
3	15.5	3.09276853	24

Mean for entire sample:14.6842105 Standard Deviation:3.30523956 N:38

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	17.4168646
3	20.9651623

99

ANALYSIS OF VARIANCE

BLACK MALES AND WHITE FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:1 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	214.426341	1	214.426341	7.31725085	.0098
A	167.498927	1	167.498927	5.71586337	.0206
WITHIN	1113.56043	38	29.3042217		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
1	16.7857143	6.75025438	14
4	21.7037037	5.3191585	27

Mean for entire sample:20.0243903 Standard Deviation:6.22690855 N:41

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
1	13.2857143	3.29168116	14
4	14.1481481	3.24278728	27

Mean for entire sample:13.8536585 Standard Deviation:3.24469544 N:41

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
1	17.1943214
4	21.4918334

A N A L Y S I S O F V A R I A N C E

BLACK FEMALES AND WHITE MALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:2 3

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	94.4757659	1	94.4757659	3.98726242	.0502
A	28.9927631	1	28.9927631	1.22361278	.2751
WITHIN	900.386964	38	23.6943938		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
2	19.2941176	4.98453488	17
3	21.3333333	5.09617648	24

Mean for entire sample:20.4878049 Standard Deviation:5.08980325 N:41

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
2	14.8235294	3.48631778	17
3	15.5	3.09276853	24

Mean for entire sample:15.2195122 Standard Deviation:3.23660465 N:41

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
2	19.4831733
3	21.1994189

ANALYSIS OF VARIANCE

BLACK FEMALES AND WHITE FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:2 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	237.100245	1	237.100245	10.8487414	.0023
A	86.2724168	1	86.2724168	3.94747435	.0508
WITHIN	896.058789	41	21.8550924		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
2	19.2941176	4.98453488	17
4	21.7037037	5.3191585	27

Mean for entire sample:20.7727273 Standard Deviation:5.26888026 N:44

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
2	14.8235294	3.48631778	17
4	14.1481481	3.24278728	27

Mean for entire sample:14.4090909 Standard Deviation:3.31534963 N:44

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
2	18.999092
4	21.8894606

A N A L Y S I S O F V A R I A N C E

WHITE MALES AND WHITE FEMALES WHEN GROUPS ARE COMBINED

SUMMARY OF DESIGN

Name of Data File: COOP LEARNING DATA
Dependent variable:4 Missing Value Code:-999999
Covariate (variable number):3 MISSING VALUE CODE:-999999

Independent variable (A): VAR2 CODES:3 4

ANALYSIS OF VARIANCE

EFFECT	SS	df	MS	F	P
Covariate	171.843413	1	171.843413	7.10390584	.0101
A	16.5593616	1	16.5593616	.68455429	.4172
WITHIN	1161.11953	48	24.1899903		

TABLE OF MEANS AND STANDARD DEVIATIONS:

Means and Standard Deviations for Dependent Variable (Variable 4):

CODES VAR (2)	MEAN	STDV	N
3	21.3333333	5.09617648	24
4	21.7037037	5.3191585	27

Mean for entire sample:21.5294118 Standard Deviation:5.16663501 N:51

Means and Standard Deviations for Covariate (Variable 3):

CODES VAR (2)	MEAN	STDV	N
3	15.5	3.09276853	24
4	14.1481481	3.24278728	27

Mean for entire sample:14.7843137 Standard Deviation:3.21442824 N:51

Adjusted Means (adjusted for Covariate):

CODES VAR (2)	ADJUSTED MEAN
3	20.9109699
4	22.0791379

APPENDIX E

CORRELATION DATA

* * * * * CORRELATION (PEARSON R) * * * * *

COOP CORRELATION DATA

File Name: COOP CORRELATION DATA: 4 MISS. =-999999 LL =1 UL =14

var: 1 and var: 1

M1=32.3571429 M2=32.3571429
S1=2.15448162 S2=2.15448162
N1=14 N2=14
r(12)=1

---

var: 1 and var: 2

M1=32.3571429 M2=35.2878572
S1=2.15448162 S2=3.11154474
N1=14 N2=14
r(12)=.568836644 t= 2.39589844 p= .0322

---

var: 1 and var: 3

M1=32.3571429 M2=28.35
S1=2.15448162 S2=3.23950368
N1=14 N2=14
r(12)=.780605908 t= 4.3263942 p= .0012

---

var: 1 and var: 4

M1=32.3571429 M2=2.535
S1=2.15448162 S2=.523710862
N1=14 N2=14
r(12)=-.683790865 t= -3.24625504 p= .0070

---

var: 2 and var: 1

M1=35.2878572 M2=32.3571429
S1=3.11154474 S2=2.15448162
N1=14 N2=14
r(12)=.568836644 t= 2.39589844 p= .0322

```
var: 2  and                 var: 2

M1=35.2878572               M2=35.2878572
S1=3.11154474               S2=3.11154474
N1=14                       N2=14
r(12)=1
```

```
var: 2  and                 var: 3

M1=35.2878572               M2=28.35
S1=3.11154474               S2=3.23950368
N1=14                       N2=14
r(12)=.715510528    t= 3.54794483    p= .0042
```

```
var: 2  and                 var: 4

M1=35.2878572               M2=2.535
S1=3.11154474               S2=.523710862
N1=14                       N2=14
r(12)=-.153721091    t= -.538910825    p= .6049
```

```
var: 3  and                 var: 1

M1=28.35                    M2=32.3571429
S1=3.23950368               S2=2.15448162
N1=14                       N2=14
r(12)=.780605908    t= 4.3263942    p= .0012
```

```
var: 3  and                 var: 2

M1=28.35                    M2=35.2878572
S1=3.23950368               S2=3.11154474
N1=14                       N2=14
r(12)=.715510528    t= 3.54794483    p= .0042
```

```
var: 3  and                 var: 3

M1=28.35                    M2=28.35
S1=3.23950368               S2=3.23950368
N1=14                       N2=14
r(12)=1
```

---

var: 3 and var: 4

M1=28.35
S1=3.23950368
N1=14
r(12)=-.607413479 t= -2.64876575 p= .0202

M2=2.535
S2=.523710862
N2=14

---

var: 4 and var: 1

M1=2.535
S1=.523710862
N1=14
r(12)=-.683790865 t= -3.24625504 p= .0070

M2=32.3571429
S2=2.15448162
N2=14

---

var: 4 and var: 2

M1=2.535
S1=.523710862
N1=14
r(12)=-.153721091 t= -.538910825 p= .6049

M2=35.2878572
S2=3.11154474
N2=14

---

var: 4 and var: 3

M1=2.535
S1=.523710862
N1=14
r(12)=-.607413479 t= -2.64876575 p= .0202

M2=28.35
S2=3.23950368
N2=14

---

var: 4 and var: 4

M1=2.535
S1=.523710862
N1=14
r(12)=1

M2=2.535
S2=.523710862
N2=14

---

* * * * * CORRELATION (PEARSON R) * * * * *

GROUP AVERAGES ON 6 TESTS

File Name: GROUP AVERAGES ON 6 TESTS: 2 MISS. =-999999 LL =1 UL =6

var: 1 and var: 2

M1=24.07 M2=29.44
S1=2.39156847 S2=3.00806913
N1=6 N2=6
r(4)=.905326262 t= 4.26319969 p= .0141

---

* * * * * CORRELATION (PEARSON R) * * * * *

SHORT TERM AND LONG TERM ACHIEVEMENT CORRELATION

File Name: TERM CORRELATION: 2 MISS. =-999999 LL =1 UL =16

var: 1 and var: 2

M1=.11269125 M2=.33331875
S1=.205795317 S2=.243823994
N1=16 N2=16
r(14)=-8.39274228E-03 t= -.0314038722 p= .9253

APPENDIX F

DATA FILES

Name of Data File: COOP LEARNING DATA

```
Subject: 1   1 4 12 23 23.17 2 2
Subject: 2   1 1 11 18 19.5 1 1
Subject: 3   1 2 12 22 32.33 2 1
Subject: 4   1 1 19 20 19.33 1 1
Subject: 5   1 1 13 15 18 1 1
Subject: 6   1 1 15 29 23.5 1 1
Subject: 7   1 3 16 22 29 1 2
Subject: 8   1 4 16 22 26.17 2 2
Subject: 9   1 3 19 15 25 1 2
Subject: 10   1 2 15 11 20.5 2 1
Subject: 11   1 2 18 19 22 2 1
Subject: 12   1 3 16 29 36.2 1 2
Subject: 13   1 4 18 22 30.5 2 2
Subject: 14   1 4 21 29 29.33 2 2
Subject: 15   1 2 20 23 18.5 2 1
Subject: 16   1 4 11 13 20 2 2
Subject: 17   1 4 12 22 19.67 2 2
Subject: 18   1 2 16 23 23.83 2 1
Subject: 19   1 2 12 24 23.5 2 1
Subject: 20   1 3 19 20 24.33 1 2
Subject: 21   1 2 19 19 22.6 2 1
Subject: 22   1 2 12 13 16.17 2 1
Subject: 23   1 3 17 16 30.5 1 2
Subject: 24   1 3 11 13 26.67 1 2
Subject: 25   1 4 14 23 26.83 2 2
Subject: 26   1 3 15 20 29.67 1 2
Subject: 27   1 3 18 31 37 1 2
Subject: 28   1 4 11 17 16.17 2 2
Subject: 29   1 3 13 26 28.17 1 2
Subject: 30   1 1 14 7 17 1 1
Subject: 31   1 1 16 10 19.8 1 1
Subject: 32   1 2 10 14 19.17 2 1
Subject: 33   1 2 11 14 22 2 1
Subject: 34   1 1 14 18 14.17 1 1
Subject: 35   1 4 17 32 31.5 2 2
Subject: 36   1 3 19 20 32.83 1 2
Subject: 37   1 4 10 24 25.67 2 2
Subject: 38   1 3 12 10 17.5 1 2
Subject: 39   1 3 21 23 23.83 1 2
Subject: 40   1 3 12 20 21 1 2
Subject: 41   2 4 14 27 37.5 2 2
Subject: 42   2 4 16 23 28.67 2 2
```

CODES FOR COOP LEARNING DATA (SEE PAGE 31)

COLUMN

(1) GROUPS (1=CONTROL, 2=EXPERIMENTAL)
(2) RACE-SEX (1=BLACK-MALE, 2=BLACK FEMALE,
3=WHITE-MALE, 4=WHITE FEMALE)
(3) PRETEST SCORES = NUMBER OF CORRECT RESPONSES
OUT OF 40 POSSIBLE CORRECT
ANSWERS.
(4) POSTTEST SCORES = NUMBER OF CORRECT RESPONSES
OUT OF 40 POSSIBLE CORRECT
ANSWERS.
(5) CHAPTER TEST AVERAGES = AVERAGE FOR SIX
CHAPTER TESTS.
(6) SEX (MALES=1, FEMALES=2)
(7) RACE (1=BLACK, 2=WHITE)

```
Subject: 43  2 3 15 18 26.33 1 2
Subject: 44  2 4 19 29 38.33 2 2
Subject: 45  2 4 18 19 27.67 2 2
Subject: 46  2 4 13 13 20.33 2 2
Subject: 47  2 1 12 12 20.83 1 1
Subject: 48  2 4 10 19 31.83 2 2
Subject: 49  2 1 14 20 27.83 1 1
Subject: 50  2 4 18 22 21 2 2
Subject: 51  2 3 19 26 21.33 1 2
Subject: 52  2 1 11 12 21 1 1
Subject: 53  2 2 14 16 25.33 2 1
Subject: 54  2 1 11 12 20.83 1 1
Subject: 55  2 2 19 29 30.67 2 1
Subject: 56  2 4 11 19 33.5 2 2
Subject: 57  2 4 11 24 34.17 2 2
Subject: 58  2 3 14 29 37.33 1 2
Subject: 59  2 1 16 31 36.83 1 1
Subject: 60  2 4 10 11 19.67 2 2
Subject: 61  2 2 9 16 24.5 2 1
Subject: 62  2 2 18 21 34 2 1
Subject: 63  2 4 11 27 35.33 2 2
Subject: 64  2 1 15 15 22.33 1 1
Subject: 65  2 4 16 24 32.17 2 2
Subject: 66  2 4 18 27 40.5 2 2
Subject: 67  2 2 13 23 34.83 2 1
Subject: 68  2 3 12 25 31.17 1 2
Subject: 69  2 3 11 19 22.67 1 2
Subject: 70  2 2 18 16 27.5 2 1
Subject: 71  2 4 12 18 22.67 2 2
Subject: 72  2 3 16 21 27.83 1 2
Subject: 73  2 3 17 25 34 1 2
Subject: 74  2 1 5 16 19.83 1 1
Subject: 75  2 3 11 19 27.17 1 2
Subject: 76  2 3 20 20 34.33 1 2
Subject: 77  2 4 12 19 27.67 2 2
Subject: 78  2 4 16 13 27.67 2 2
Subject: 79  2 3 15 20 37.33 1 2
Subject: 80  2 3 14 25 26.33 1 2
Subject: 81  2 4 15 25 38 2 2
Subject: 82  2 2 16 25 35.5 2 1
```

Name of Data File: COOP CORRELATION DATA

Subject: 1 32 38.83 28.76 2.67
Subject: 2 30.33 28.67 25.81 2.4
Subject: 3 30.17 34.17 24.18 2.56
Subject: 4 32.17 30.67 26.74 2.33
Subject: 5 34 37 29.89 2.44
Subject: 6 37.67 40.5 37.17 1.31
Subject: 7 32.33 34.83 28.31 2.37
Subject: 8 32 36.2 30.29 2.93
Subject: 9 33.33 34 24.61 3
Subject: 10 30.67 37.33 27.35 3.45
Subject: 11 32.83 34 27.21 2.08
Subject: 12 30.67 35.5 28.78 2.42
Subject: 13 29.83 34.33 26.8 3.22
Subject: 14 35 38 31 2.31

CODES FOR COOP CORRELATION DATA (SEE PAGE 28)

COLUMN

(1) GROUP TEST AVERAGE ON SIX CHAPTER TESTS.
(2) INDIVIDUAL IN GROUP WITH HIGHEST TEST SCORE AVERAGE ON SIX CHAPTER TESTS.
(3) GROUP AVERAGE ON INDIVIDUAL GROUP MEMBER TESTS ON SIX CHAPTER TESTS.
(4) AVERAGE GROUP PLACEMENT ON SIX CHAPTER COMPETITIONS.

Name of Data File: GROUP AVERAGES ON 6 TESTS

Subject: 1 22.58 26.17
Subject: 2 23.9 30.95
Subject: 3 22.76 29.21
Subject: 4 28.05 34
Subject: 5 21.53 26.14
Subject: 6 25.6 30.17

CODES FOR GROUP AVERAGES ON SIX TESTS (SEE PAGE 29)

COLUMN

(1) CONTROL GROUP AVERAGE.
(2) EXPERIMENTAL GROUP AVERAGE.

Name of Data File: TERM CORRELATION

Subject: 1	1E-04	.219
Subject: 2	.0104	.6316
Subject: 3	3.1E-03	.3595
Subject: 4	.3381	.238
Subject: 5	.033	.219
Subject: 6	3E-04	.7254
Subject: 7	6E-04	.7254
Subject: 8	.0134	.6266
Subject: 9	.316	.2714
Subject: 10	1.5E-03	.0123
Subject: 11	.106	.4585
Subject: 12	2.7E-03	.0827
Subject: 13	3.2E-03	.0206
Subject: 14	.1092	.2751
Subject: 15	.097	.0508
Subject: 16	.7683	.4172

CODES FOR TERM CORRELATIONS (SEE PAGES 33 AND 34)

COLUMN

(1) PROBABILITY LEVELS FOR SHORT TERM ITEMS EXCEPT ITEM 5. SEE PAGE 33 FOR DETAILS.

(2) PROBABILITY LEVELS FOR LONG TERM ITEMS EXCEPT ITEM 5. SEE PAGE 34 FOR DETAILS.

APPENDIX G

GRANT LETTER OF CONGRATULATIONS

Alexandria City Public Schools
Alexandria, Virginia

January 8, 1989

James Kinney
George Washington Jr. High School
Alexandria, Virginia

Dear Jim,

Congratulations on your 1988-89 Mini-Grant Award provided by Alexandria City School Board to promote excellence in education and encourage teacher initiative in developing new teaching techniques and improving existing programs in our school division.

Your award of $ 1,759 will be used to promote cooperative learning for MAP students in the biology classes in your school.

You may immediately prepare purchase requisitions for equipment and materials needed for your project. Use normal purchasing procedures whenever possible. If you are purchasing computer hardware, software, or computer supplies, contact Rose Alston at 998-8298 in the Media Center for purchasing information. You must purchase equipment and supplies on Alexandria's bid list. When purchase orders have been completed and signed by you and your principal, forward them to my office for processing.

All recipients of Alexandria Mini-Grants are required to furnish a report of their projects by May 15, 1989 and may be asked to share information on their projects with other teachers in a Mini-Grant Fair in June 1989.

Sincerely yours,

JPA

JAMES P. AKIN
Director of Funded Programs
998-2123

c: Dr. Sny

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